ELEG 312 Formula Sheet

First Midterm Exam

March 21, 2000

$$\text{Voltage gain } (A_v) = \frac{v_O}{v_I}, \quad \text{in dB} \quad 20\log|A_v| \tag{1}$$

$$\text{Current gain } (A_i) = \frac{i_O}{i_I}, \quad \text{in dB} \quad 20\log|A_i| \tag{2}$$

$$\text{Power gain } (A_p) = \frac{P_L}{P_I}, \quad \text{in dB} \quad 10\log|A_p| \tag{3}$$

$$A_v = \left.\frac{dv_O}{dv_I}\right|_{\text{at Q}} \tag{4}$$

$$A_{vo} = \left.\frac{v_o}{v_i}\right|_{i_o=0} (V/V), \quad A_{is} = \left.\frac{i_o}{i_i}\right|_{v_o=0} (A/A) \tag{5}$$

$$G_m = \left.\frac{i_o}{v_i}\right|_{v_o=0} (A/V), \quad R_m = \left.\frac{v_o}{i_i}\right|_{i_o=0} (V/A) \tag{6}$$

$$T(\omega) = \frac{V_o(\omega)}{V_i(\omega)}, \quad T(s) = \frac{V_o(s)}{V_i(s)} \tag{7}$$

$$\frac{K}{1+(s/\omega_0)}, \quad \frac{Ks}{s+\omega_0}, \quad s = j\omega \tag{8}$$

$$y(t) = Y_\infty - (Y_\infty - Y_{0+})e^{-t/\tau} \tag{9}$$

$$\frac{v_O}{v_I} = -\frac{R_2}{R_1}, \quad \frac{v_O}{v_I} = \frac{-R_2/R_1}{1+(1+R_2/R_1)/A} \tag{10}$$

$$\frac{V_o(s)}{V_i(s)} = -\frac{Z_2(s)}{Z_1(s)} \tag{11}$$

$$v_O(t) = -\frac{1}{CR}\int_0^t v_I(t')\,dt' - V_C \tag{12}$$

$$\frac{V_o(s)}{V_i(s)} = -\frac{1}{sCR} \tag{13}$$

$$v_O(t) = -CR\,\frac{dv_I(t)}{dt} \tag{14}$$

$$\frac{V_o(s)}{V_i(s)} = -sCR \tag{15}$$

$$\frac{v_O}{v_I} = 1 + \frac{R_2}{R_1}, \quad \frac{v_O}{v_I} = \frac{1+(R_2/R_1)}{1+[1+(R_2/R_1)]/A} \tag{16}$$

$$A(s) = \frac{A_0}{1+s/\omega_b}, \quad \omega_t = A_0\,\omega_b, \quad A(s) \simeq \frac{\omega_t}{s} \tag{17}$$

$$I_B = \frac{I_{B1}+I_{B2}}{2}, \quad I_{OS} = |I_{B1}-I_{B2}| \tag{18}$$

$$i = I_S(e^{v/nV_T}-1) \simeq I_S e^{v/nV_T}, \quad V_T = \frac{kT}{q} \tag{19}$$

$$V_2 - V_1 = 2.3\,nV_T \log\frac{I_2}{I_1} \tag{20}$$

$$n_i^2 = BT^3 e^{-E_G/kT} \tag{21}$$

$$J_p = -qD_p\,\frac{dp}{dx}, \quad J_n = qD_n\,\frac{dn}{dx} \tag{22}$$

$$v_{drift} = \mu_p E, \quad \frac{D_n}{\mu_n} = \frac{D_p}{\mu_p} = V_T \tag{23}$$

$$n_{n0} \simeq N_D, \quad p_{p0} \simeq N_A, \quad n_{n0}p_{n0} = n_i^2 = n_{p0}p_{p0} \tag{24}$$

$$V_0 = V_T \ln\left(\frac{N_A N_D}{n_i^2}\right) \tag{25}$$

$$r_d = \frac{nV_T}{I_D} \tag{26}$$